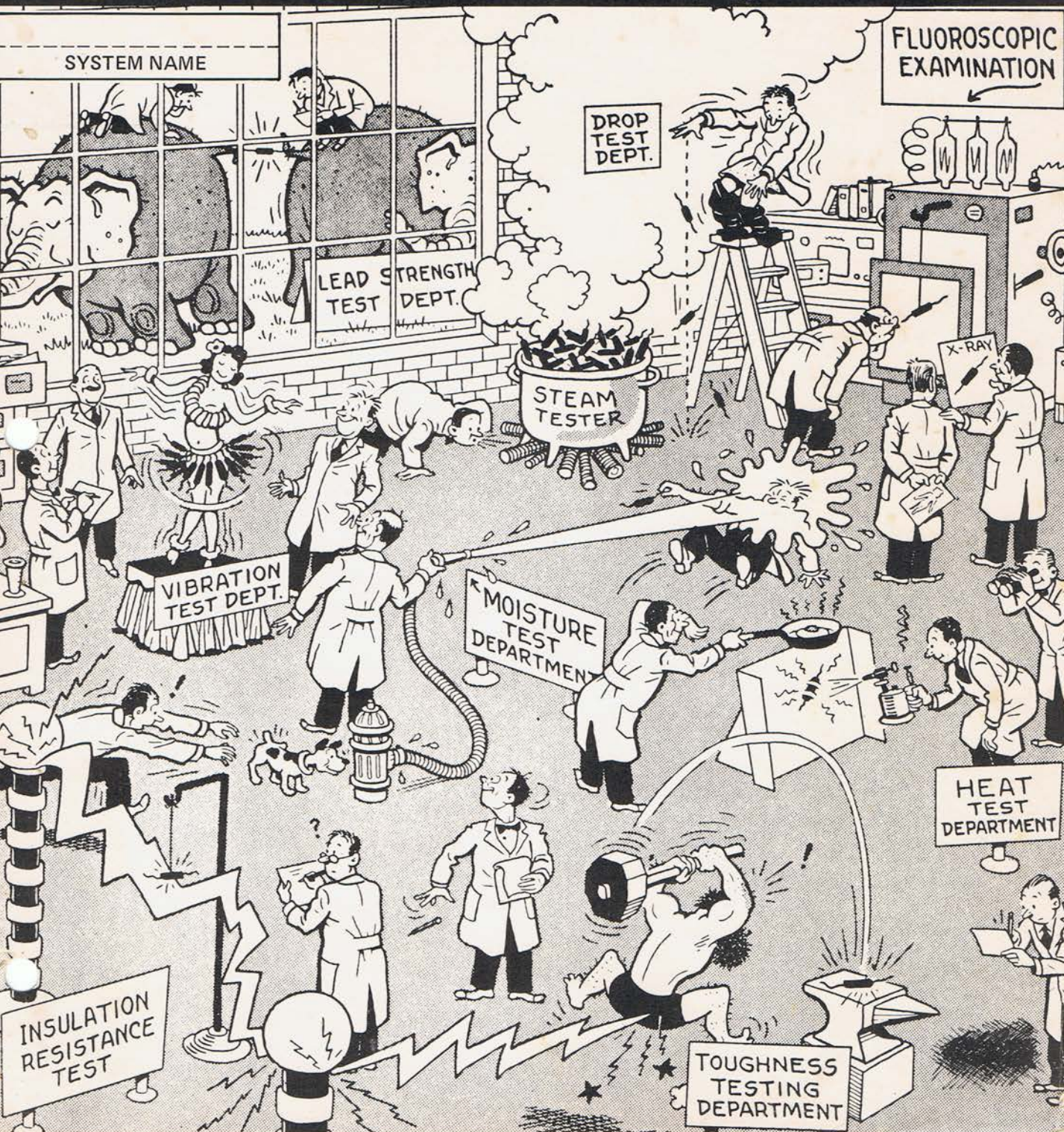
CATJ COOK BOOK FOR 1974/75 FCC MEASUREMENTS



COMPLYING WITH ANNUALIZED FCC MEASUREMENTS FOR 1974/75

MEASUREMENTS FOR 1975

On or before March 31, 1975 a series of system measurements must be completed by all systems. These are the "Phase Two Measurements" required under the Rules and Regulations of Part 76 (1).

The CATV industry is, at best, *slightly confused* by the measurement requirements dictated by Part 76. The primary confusion is the fact that *all systems must make certain measurements* on or before March 31, 1975, but that *only specified systems must comply* with the technical requirements of Part 76.

All systems (i.e. any system with more than 50 paying subscribers) are required to comply with all of the provisions of Part 76. Systems in operation prior to March 31, 1972 *comply by making measurements* in phased groups that began March 31, 1974 and continue through March 31, 1977. *Complying with the rules* for these *grandfathered systems* is full and complete by *merely making the tests* required in 1974, 1975, and 1976. . . 1977 is a separate matter, as we shall see.

For grandfathered systems, compliance (up to 1977) *is merely a matter of making measurements.* Technical compliance, that is system technical compliance, does not become mandatory until 1977. However, interim compliance, or the making of certain specified tests, is no matter to be taken lightly.

Section 76.601 (c) states, "the operator. . . shall maintain the resulting test data on file at the system's local office for at least five years. It shall be available for inspection by the Commission on request."

This simply means you *must make the tests* required, and *keep the written records of the tests* in your files for a period of not less than five years. Should an authorized representative of the Commission appear on the scene, you are directed to allow him to inspect those records.

If you do these things, and are a grandfathered (pre-March 31, 1972) system, *you have complied.*

What about a system that was not in operation prior to March 31, 1972? That is, a system that came into being after the Cable Television Report and Order of 1972, and is therefore operating under the written authority of a Certificate of Compliance (CAC). What about the measurements which it must perform, and the standards to which it must adhere?

All systems that began operation after March 31, 1972 are assumed to be legal systems, operating *with* CAC approval. Among the many things they agreed to do in order to obtain their CAC was to obey (i.e. live under) the Rules and Regulations of Part 76, which *includes* Sections 76.605 (technical standards) and 76.609 (measurements). Thus, all such systems must not only make measurements, as set

forth in Section 76.609, but must also assure themselves that the systems meet or exceed the technical requirements of 76.605. This is directly contrary to so-called grandfathered systems, which are required to make certain measurements each year through 1977, but do not have to have system technical compliance (with 76.605) until 1977.

If all of this is still confusing, check the box insert here for what you have to do, in either system category.

EXCEPTIONS

Grandfathered systems are allowed to make their measurements in phases; that is, only certain tests were required on or before March 31, 1974. Those same tests, plus *a few additional tests*, will be required on or before March 31, 1975. All of the 1974 and the 1975 tests, *plus yet more additional tests*, will be required by March 31, 1976. Finally, by March 31, 1977, all of the tests spelled out in 76.609 (pursuant to the technical standards spelled out in 76.605) will be required. At the same time, the system must *also* have technical compliance (with 76.605). The "phases" are spelled out in the box insert shown here.

Although all systems that began operation after March 31, 1972 are assumed to be in full technical compliance with the provisions of 76.605 at all times, and all measurements are to be made annually (1), there are two exceptions. Two of the measurements required have been suspended pending further study. They are 76.605 (a) (9)... ...a measurement of co-channel interference levels, and 76.605 (a) (10)...a measurement of intermodulation distortion. We will have more to say about this shortly. For now, understand that *if your system is new* (after 3-31-72) *you are required to annually make all measurements*, except those for 76.605 (a) (9) and 76.605 (a) (10). Even

WHO MAKES WHAT/WHEN?

Grandfathered systems were required to make the following measurements prior to March 31, 1974:

(1) **76.605 (a) (4)**—Visual signal level (minimum) on all channels;

(2) **76.605 (a) (5)**—Signal level variations between adjacent channels and all channels;

(3) **76.605 (a) (6)**—DB difference between all visual carriers and their companion aural carrier levels;

(4) **76.605 (a) (9)**—Signal-to-noise ratio of all Grade B or better grade signals;

(5) **76.605 (a) (12)**—Radiation from cable plant;

Grandfathered systems are required to re-make all of the above (1974) measurements **plus** the following new measurements prior to March 31, 1975:

(6) **76.605 (a) (7)**—Measurement of percentage of hum modulation present;

(7) **76.605 (a) (8)**—Measurement of in-channel response;

(8) **76.605 (a) (11)**—Measurement of terminal isolation between any two subscribers;

New systems are required to make all of the above measurements before March 31, 1975, **and** the following:

(9) **76.605 (a) (1)**—Measurement of frequency boundaries of all off-the-air system channels;

(10) **76.605 (a) (2)**—Measurement of visual carrier frequencies of all system off-the air channels;

(11) **76.605 (a) (3)**—Measurement of separation of visual and aural carriers.

New systems must **comply** with the specifications of 76.605 (a) 1 through 12 (including compliance with the Radiation Standards). **Measurement** of co-channel interference levels [76.605 (a) (9)] and intermod [76.605 (a) (10)] are presently waived, **although compliance is not.** All of these measurements will be discussed at length in the December CATJ.

(1—See data given above)

though you are not required to make measurements for 76.605 (a) (9) and 76.605 (a) (10), you are required to *certify your system complies* with the requirements of 76.605 (a) (9) and 76.605 (a) (10).

How is that again? We must comply with the technical requirements of co-channel (36 db or more down within Grade B pick-ups) and intermod (46 db or more down), *but we are not required to measure it?* That's it in a nutshell. We are told that the Commission has chosen this strange approach to these two measurements because both measurements require sophisticated equipment (a spectrum analyzer) to perform. The Commission has directed the C-TAC group to study how the *"intent* of the technical requirements could be met" *without actual measurements* being made. Since the C-TAC panel is still out, and will not make firm recommendations to the Cable Bureau until January 31st, the matter of measuring these two specifications for your system has been suspended, pending the receipt of the C-TAC study.

This year new systems are required to make all measurements, and old systems are required to make certain measurements, but only new systems are required to comply with the technical standards of 76.605. There is one standard or provision of 76.605 with which all systems including old systems, must comply. *That standard is 76.605 (a) (12), which is the radiation standard.* In 76.605 (a) (12) the Commission has gone back and picked up an old (pre-cable) set of rules originally known as Part 15 (something called "incidental radiation"). In the original "incidental radiation" standards, the Commission sought to assure that unlicensed devices did not interfere with the reception of licensed transmitters. If you will look on the back of most any television or radio receiver, transceiver, etc. you will see a sticker which states, *"This Unit Complies With Part 15 Radiation Standards, In Effect At The Time of Manufacture",* or something similar. Here the Commission is worried about things like receiver local oscillators radiating throughout the neighborhood and becoming unwanted interfering signal sources that disrupt normal receiver operation. When it was found that cable television systems could on occasion radiate signals up and down the block, the standards of Part 15 were enlarged to include CATV. So, from virtually day-one of this industry, we have had something similar (if not identical) to 76.605 (a) (12). The Commission has had the authority, under earlier Part 15, to make life pretty miserable for any CATV system that was found to be line (or plant or apparatus) radiating more signal than the permissible standards allowed. *There is nothing new about this standard, and it applies equally to all systems (old and new).*

GRANDFATHER MEASUREMENTS

If you are a new system, you have gone into the CATV business with nothing less than a full understanding that you would be required to make measurements each year you were in operation. Our theory in presenting this material in this issue, and completing it in the next issue, is that as a part of that understanding, you comprehend the legal and technical requirements for making these tests, and that you have already made *one full set* of tests on or before March 31, 1974.

On the other hand, grandfathered systems are making *many of their tests for the first time* this year. These new tests which approximately 2,900 systems have never been required to perform before, are the tests to which we shall devote the majority of our report. We will also cover all of the grandfather-system-required tests for

this year, which includes the tests that were made for the first time last year. Our theory is that in making the tests for the first time last year, *you may have done more (or less) than is really required,* and now is as good a time to catch the error.

WHERE TESTS ARE MADE

One of the items which confuses some operators is the location of the tests. Section 76.601 (c) states that, "... *tests shall be made on each* (off-the-air) *cable television channel...at no less than three widely separated points in the system, at least one of which is representative of the terminals most distant from the system* (head end)."

To satisfy the testing requirements, each system must make identical full-range measurements at no fewer than *three locations.* This does not mean that a system can comply with the technical standards of 76.605 at *only* three (minimum locations). It means *the tests,* to validate the testing procedure, *must be done at no fewer than three locations.* As a matter of fact, the Commission may require "...additional tests, repeat tests, or tests involving specific subscriber terminals...to secure compliance with the technical standards".

The Commission also says, *"Successful completion of the performance tests* (at the three designated locations) *does not relieve the system of the obligation to comply with all pertinent technical standards at all subscriber terminals."* Of course, for now, this pertains mostly to newer systems. The point is made that "handpicking three prime locations" and conducting your tests at these locations is not "full compliance with the technical standards", but rather *is compliance only with the measurement* (instruction) *requirement.*

Once again, many operators are confused with the difference between measurement requirements, and technical standards. *The measurement requirement is essentially a paper-work function.* Recall that when you make your measurements, you must compile a written log of the measurements (see box insert) and maintain those measurement logs on file for at least five years at your system office. In effect, *making these measurements satisfies only the requirement that you make measurements.* It is up to you, having made the measurements, to determine *whether or not your system meets the*

KEEPING PROPER RECORDS

Section 76.601 spells out how system performance tests shall be recorded. All systems, new or old, shall:

(A) Maintain at their in-town office a complete listing of all stations (and channels) carried on the system, showing channels added or deleted as permanent changes take place;

(B) Maintain a listing of all subscribers connected to the system;

(C) Conduct system performance tests once per calendar year, but in no case any less frequently than at 14 month intervals;

(D) Maintain as a part of the recorded test procedure a description of the equipment utilized to make the tests, and a statement of the general qualifications of the individual(s) conducting the tests;

(E) Record the results of all tests made, and keep those test results on file for a period of not less than five years;

(F) Make the full set of records listed here available to any authorized employee of the Commission, and be prepared to show that the record keeping process (grandfathered systems) and the measurements themselves (new systems) are in full FCC compliance.

technical standards set forth in 76.605, which is an entirely *different* situation. A grandfathered system is totally exempt from meeting any *technical standards* [except radiation, 76.605 (a) (12)] until March 31, 1977.

Must the measurements be made inside of subscriber homes? *No.* Section 76.601 (c) states, "...the measurements may be taken at convenient monitoring points in the cable network, provided that data shall be included (in the written test results) to relate the measured performance (taken at the monitoring point) to the system performance as would be viewed from a nearby subscriber terminal."

Again, this confuses some operators. Let's go back to "three widely separated points in the system". Can one of these be at the head end? *Probably* not, because 76.601 (c) says "...as would be viewed from a nearby subscriber terminal". You might argue that you *could* have a subscriber at (or near) the head end, and in some cases you may actually start service *right outside* the head end site. In fact, you had better at least have a potential customer *and a way to serve him* (i.e. a feeder line or a DT in the trunk) *at the location*, if you choose the head end for one of your three measurement points. Sure, some systems use their head end test point, through a splitter or DT, to serve a farm house located on the same property as the head end, but that is "pretty thin" to defend. It is virtually *impossible* to defend if you have *no potential subscribers* within reasonable service distance from the head end. ("Would you believe a family lived in a trailer right outside the head end door, and they *just* pulled the trailer away as you drove up?" This might be hard for the visiting FCC man to swallow!).

There will probably never be anything like a *standard set of three measurement locations* in this business, but they might be as follows:

(1) *The head end* (if you can substantiate that a customer is being served or could be served from there);
(2) *Your office* (assuming it is on the cable);
(3) *A customer service location at the far end of the plant* [this satisfies 76.601 (c) "...at least one of which is representative of terminals most distant from the system (head end) in terms of cable distance..."].

The term *representative of terminals* keeps cropping up. What does it mean? It means that you can make the measurements *at some location other than inside of a subscriber's home.* For example, if you are at the number three location suggested above (the most distant cable point in the plant), you could be making your measurements (1) *inside the home* at the end of the drop cable at the end of the longest and most distant feeder run in the plant, (2) *outside of the home*, off of the service DT using an unused output port on the DT, or (3) *off of the output* (or even input, although we cannot fathom why you would want to) test point on the last amplifier in the line.

To the Commission, representative means that *when* you measure at any physical point *except* the specified in-home location, that *your measurements be corrected* for additional passive losses that could (or would) exist between the point of actual measurement and the point of actual connection to the subscriber's antenna terminals. In other words, make your measurements at the DT unused port if you wish to avoid disrupting the subscriber's life for twenty four hours (*24 hours?* Yes, we will get to that shortly.). When you note your measurement levels in your log, subtract from your RF level type measurements (and others that are quantitative in nature) *any additional loss that would occur from the DT test plug-in point to the*

subscriber's receiver (such as cable losses for 100 feet of RG-59/U drop cable). These "adjusted" numbers are the numbers you log, so that your log *represents* the real levels inside of the home.

This same situation exists for the other two measurements as well, when they are made at any point *except* at the end of the drop cable where it plugs into the matching transformer hanging on the back of the subscriber's receiver.

24 HOURS?

If you rushed right out and purchased a copy of the *Federal Register* for February 12, 1972 (which contained the initial 1972 release of the Part 76 Rules and Regulations), you probably missed the "later update" released in June, 1972 in the *Cable Television Report and Order and Reconsideration.* In the "reconsideration", Section 76.605 (a) (5) was modified to read:

> "The visual signal level on each channel shall not vary more than 12 db *within any 24 hour period* and shall be maintained within:
>
> (i) 3 db of the visual signal level of any visual carrier within 6 MHz nominal frequency separation, and (ii) 12 db of the visual signal level on any other channel, and (iii) a maximum level such that signal degradation due to overload in the subscriber's receiver does not occur."

The portion added in italics (*within any 24 hour period*) may have missed your attention previously. This little "hooker" changes the rules of the game substantially. Previously where you could "best case" yourself into compliance, now you are required to stretch your "best case" into a period of at least 24 hours in length! We will deal with how you can comply with 76.605 (a) (5) subsequently.

MULTIPLE SYSTEM TESTS

There is one more confusing point in the rules. Because the Commission determined in their Cable Television Report and Order [76.5 (a)] that "*. . . in general, each separate and distinct community or municipal entity (including single, descrete, un-incorporated areas) served by cable television facilities constitutes a separate cable television system, even if there is a single head end and identical ownership of facilities extending into several communities*", you *may* have more than one complete set of tests to make.

Let's suppose you have your primary system in Podunk, a municipal entity which granted your firm a franchise. This requires three measurement *points, all located within Podunk* proper. Now you have extended your trunk into *Left Overshoe*, a smaller community that is served by the Podunk trunk after it goes through Podunk. You have a franchise for Left Overshoe, or at least permission to operate there, and you file a separate Form 325 on the Left Overshoe system. That is three more measurement points, except *these three must all be within Left Overshoe.* Finally, between Podunk and Left Overshoe (or beyond Podunk) you are *also serving* a group of customers in the country. They happen to number *51 subscribers*, which makes them a legal *separate* cable facility. You have no franchise at the moment (for whatever reason), but the system *is separate and distinct* as far as the FCC is concerned because the 51 homes served are outside of Podunk or Left Overshoe, and that is *three more measurement points.*

If Left Overshoe, or the un-incorporated area happen to have fewer than 50 subscribers, the Commission doesn't call these separate facilities *"CATV Systems"* and therefore, no measurements are required.

Before you go straight through the roof, remember how glad you were when you found out that each separate, distinct system had to have more than 500 subscribers before that nasty cherry picker station up the road could force you to provide non-duplication protection? When you *split up your billings* into Left Overshoe, Podunk, and the un-incorporated area [following Commission 76.5 (a) guidelines], you found that Podunk had 476 subscribers, Left Overshoe had 123, and the un-incorporated area had 51. This is a net effect of 650 homes connected to the head end, *but in no case 500 in any one* (community) *system.*

At that point you *loved* having (by FCC definition) three "separate" systems. Now, you are going to have to pay a small price (two more sets of measurements) for that luxury!

WHAT NEXT

Now that we have established the "ground rules" for the measurement technique, or at least the record keeping portion and the definition segment, what about the actual measurements?

76.605 (a) (4)

This is the visual signal level measurement required for all Class I (i.e. off-the-air signal) channels. This section states that *"The visual signal level, across a terminating impedance which correctly matches the internal impedance of the cable system as viewed from the subscriber terminals, shall be not less than the following value:*

75 ohms . . . . . 1 millivolt".

One millivolt is the same as 1,000 microvolts, which is also the same as 0 dbmv.

Steps:

(1) Disconnect the subscriber drop cable from the receiver (1) and connect to the RF input jack on your *calibrated* FSM/SLM;

(2) If your FSM/SLM has both peak and average detection, place in the *peak detection* mode;

(3) Carefully peak the tuning of the FSM/SLM on the visual carrier of all channels carried on the system which originate at a television broadcast, translator source and record same. This includes channels delivered to you via microwave, having been picked up *off-the-air* at some distant point. Note the indicated level on your testing form (2) for each channel;

(4) Note on your testing form the make, model, and serial number (if known) of the FSM/SLM device utilized for the measurements;

(5) Note on your testing form the name and title (i.e. "system owner", "technician", etc.) of the *individual* making the tests, and the date and time of the tests, along with the street address (location) where the tests were made.

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1) Measurements do not have to be taken "literally" at the end of a subscriber drop. Section 76.601 (c) states "The measurements may be taken at convenient monitoring points in the cable network, provided that data shall be included to relate the measured performance to the system performance as would be viewed from a nearby subscriber terminal." This means that if you have 6 db of cable loss in the drop at channel 13, and 2.5 db of cable loss at channel 2, that the measurement made at a "convenient monitoring point" must be numerically compensated to relate to the actual levels that would be found inside the home at the drop terminus.

VISUAL SIGNAL LEVEL MEASUREMENT LOGGING FORM

SYSTEM NAME _____

Address _____

Town _____ State _____ Zip _____

Test Equipment Employed:

(1) FSM/SLM - _____ S/N _____

Testing Performed By:

(1) Name _____ Title _____

(2) Name _____ Title _____

Location One: _____ Address

Location Two: _____ Address

Location 3: _____ Address

_____ dbmv	_____ dbmv	_____ dbmv	CHANNEL TWO
_____ dbmv	_____ dbmv	_____ dbmv	CHANNEL THREE
_____ dbmv	_____ dbmv	_____ dbmv	CHANNEL FOUR
_____ dbmv	_____ dbmv	_____ dbmv	CHANNEL FIVE
_____ dbmv	_____ dbmv	_____ dbmv	CHANNEL SIX
_____ dbmv	_____ dbmv	_____ dbmv	CHANNEL SEVEN
_____ dbmv	_____ dbmv	_____ dbmv	CHANNEL EIGHT
_____ dbmv	_____ dbmv	_____ dbmv	CHANNEL NINE
_____ dbmv	_____ dbmv	_____ dbmv	CHANNEL TEN
_____ dbmv	_____ dbmv	_____ dbmv	CHANNEL ELEVEN
_____ dbmv	_____ dbmv	_____ dbmv	CHANNEL TWELVE
_____ dbmv	_____ dbmv	_____ dbmv	CHANNEL THIRTEEN
_____	_____	_____	(Date respective tests made)

_____ (Signature Individual Doing Tests)

Qualifications of Individual(s) Conducting Tests:

(1) _____

(2) _____

76.605 (a) (5)

This is the signal level *variation* measurement required for all Class I (broadcast television) channels. This section states *"The visual signal level on each (Class I) channel shall not vary more than 12 decibels within any 24 hour period, and shall be maintained within: (i) 3 decibels of the visual signal level of any visual carrier within 6 MHz nominal frequency separation, and. (ii) 12 decibels of the visual signal level on any other channel, and (iii) a maximum level such that visual degradation due to overload in the subscriber's receiver does not occur".*

See Diagram 1 here. This diagram shows one of the worst case (but passable) number-sets which you could measure, and pass. Channels 2 and 3 are adjacent. They are *within 3 db* of one another. Likewise, channels 3 and 4, which are *immediately adjacent*, are also within 3 db of one another. Channels 4 and 5, which are *not* immediately adjacent (there is a 4 MHz guard band between them) are 12 db in level apart. But 5 and 6, which are *immediately adjacent*, are within 3 db of one another.

Channels 6 and 7 are *not* immediately adjacent (in frequency). Therefore they *could be* as much as 12 db apart and still *meet* the standard. We have reverse-stepped channels 7, 8, 9, 10, 11 and 12, in 3 db increments. They are legal because *no two adjacent carriers* are more than 3 db apart in visual signal level. Twelve and 13 are also 3 db apart, although the channel 13 level is once again higher than the 12 level, since at 12 we have reached the 0 dbmv *"minimum signal level"* prescribed by 76.605 (a) (4).

It should be emphasized that this *particular* example meets the requirements, *but* your plant operation at these levels, through active amplifiers, would probably be *very poor*. Allowing channels 5 and 6 to run so much higher than 3, for example, would probably eventually cause 3 to be lost in a mixture of inner-mod and noise.

Steps:

(1) Disconnect the subscriber drop cable from the receiver (1) and connect to the RF input jack on your calibrated FSM/SLM;

(2) If your FSM/SLM has both peak and average detection, place in the *peak detection* mode;

(3) Carefully peak the tuning of the FSM/SLM on the visual carrier frequency of all channels carried on the system which are received through direct or microwave delivered off-the-air reception techniques;

(4) Note on your testing form the make, model, and serial number (if known) of the FSM/SLM device utilized for the measurements;

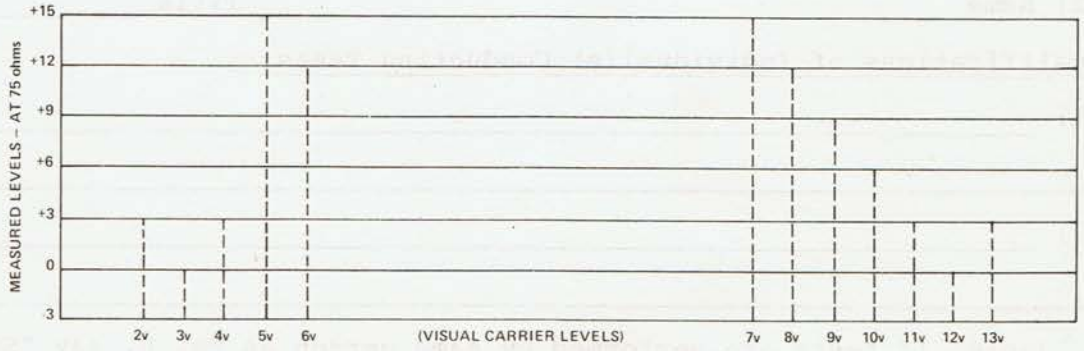


DIAGRAM 1

(5) This section requires that you determine that *"within any 24 hour period the signal level on any channel shall not vary more than 12 db"*. Actually, you are making *two* different tests, *simultaneously*. You are determining that no two adjacent carriers are more than 3 db apart and that no two system carriers are more than 12 db apart; *and*, you are determining that no single carrier at any time varies more than 12 db within a 24 hour time span.

To follow the "letter of the rule", it would be necessary to maintain an individual chart-recorded record of the level at the measurement point on every channel on the system, for 24 hours. This would require 12 FSM/SLM units and 12 channels of chart recording apparatus to follow the "letter of the rule".

A more practical situation is to make *four measurements*, spaced approximately 6 hours apart (total of 24 hour time span), noting the test site levels on all system Class I channels for each of the measurement periods. This is the technique *recommended by CATJ* to conform to the "intent of the rule" as stated here.

(6) Note on your testing form the name and title (i.e. "system owner", "technician", etc.) of the individual making the tests, and the date, time and location (with street address) of the tests.

24 HOUR VISUAL SIGNAL STABILITY TEST - LOGGING FORM A

SYSTEM NAME _____

Address _____

Town _____ State _____ Zip _____

Test Equipment Employed:

(1) FSM/SLM _____ S/N _____

Testing Performed By:

(1) Name _____ Title _____

(2) Name _____ Title _____

Qualifications of Individual(s) Conducting Tests:

(1) _____

_____

(2) _____

_____

(Note: If tests are performed by same person as Pg. 8, say "See 8")

24 HOUR VISUAL SIGNAL STABILITY TEST - LOGGING FORM B

Location One: _____

Location Two: _____

Location Three: _____

Channel	One/Min	One/Max	Two/Min	Two/Max	Three/Min	Three/Max
2	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv
3	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv
4	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv
5	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv
6	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv
7	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv
8	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv
9	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv
10	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv
11	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv
12	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv
13	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv	____dbmv

NOTE: This test applies only to those channels which are off-the-air (i.e. broadcast) signals and does not pertain to those channels which the system may be locally originating with either video/aural, video only, or aural only signals. Indicate by circles around the channel numbers in the far left column those channels which the system carries as Class I (off-the-air) channels, and leave entry blanks for other (non Class I) channels open (i.e. do not fill in).

Dates Tests Performed: (1) _____(2) _____(3) _____

Signature Individual Doing Tests: _____

This is the visual and *associated aural carrier level* measurement required for all Class I (broadcast television) channels. This section states *"The RMS voltage of the aural signal shall be maintained between 13 and 17 decibels below the associated visual signal level"*

See Diagram 2 here.

In this measurement example, the channel 2 visual level measures 0 dbmv. The channel 2 aural level makes spec by measuring -13 dbmv (13 db difference). The channel 3 visual carrier level measures +3 dbmv, while *its associated aural carrier* makes spec at -14 dbmv (17 db difference). The channel 4 visual level shown measures +6 dbmv; its associated aural would have to measure between -7 dbmv and -11 dbmv to "make spec".

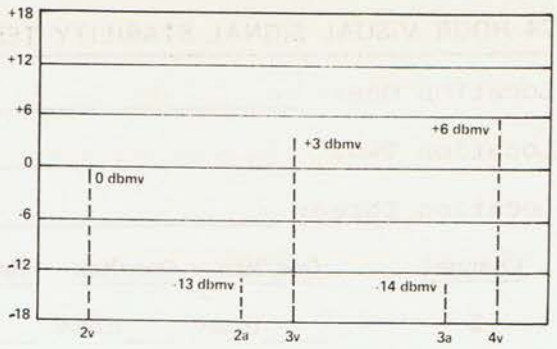


DIAGRAM 2

Steps:

(1) Disconnect the subscriber drop cable from the receiver (1) and connect to the RF input jack on your calibrated FSM/SLM;

(2) If your FSM/SLM has both peak and average detection, place in the *peak* reading mode;

(3) Carefully peak the tuning on the desired (measurement) channel *visual carrier*, and make a notation on your measurement test form of the visual carrier level present. Now *repeat the measurement* on the *aural carrier* of the measurement channel, being very careful to peak on the associated aural carrier and *not* the immediate upper adjacent visual carrier, making a notation of the level measured on your measurement test form. Repeat this test on *all* Class I (broadcast) channels on the system;

(4) Note on your testing form the make, model, and serial number (if known) of the FSM/SLM device utilized for the measurements;

(5) Note on your testing form the name, title (i.e. "system owner", "technician", etc.) of the individual making the tests, and the date, time, and location (street address) of the tests.

VISUAL / AURAL SIGNAL RATIO TEST LOGGING FORM

SYSTEM NAME _____

Address _____

Town _____ State _____ Zip _____

Test Equipment Employed:

(1) FSM/SLM - _____ S/N _____

Testing Performed By:

(1) Name _____ Title _____

(2) Name _____ Title _____

Location One: _____

Location Two: _____

Location Three: _____

Channel	One/V	One/A	Two/V	Two/A	Three/V	Three/A	
2	____	____	____	____	____	____	(dbmv)
3	____	____	____	____	____	____	(dbmv)
4	____	____	____	____	____	____	(dbmv)
5	____	____	____	____	____	____	(dbmv)
6	____	____	____	____	____	____	(dbmv)
7	____	____	____	____	____	____	(dbmv)
8	____	____	____	____	____	____	(dbmv)
9	____	____	____	____	____	____	(dbmv)
10	____	____	____	____	____	____	(dbmv)
11	____	____	____	____	____	____	(dbmv)
12	____	____	____	____	____	____	(dbmv)
13	____	____	____	____	____	____	(dbmv)

NOTE: Test pertains to Class I channels only (i.e. off-air).
Date of Tests: (1) _____ (2) _____ (3) _____ Signature: _____

This is the signal-to-noise ratio test required on all Class I (i.e. off-the-air) signals first picked up within their Grade B contours. It is important to note that these tests are *required* on *all channels which* (1) you pick up *at your head end* from a broadcast transmitter *that covers your cable community with a Grade B or higher level predicted signal level* and, (2) any microwave channels delivered to you *which are first picked off-the-air at a point within their own Grade B* (or better) contour. These measurements are *not* required on any channels which you pick up off-the-air *beyond* the predicted Grade B contours (as that contour crosses, touches or includes your cable community). This section states (in part) *"The ratio of visual signal level to system noise...shall be not less than 36 decibels"*. (This section also *mentions* co-channel interference; however, the co-channel portion of this surement requirement has been *suspended* pending further FCC/C-TAC study.)

See Diagram 3 here.

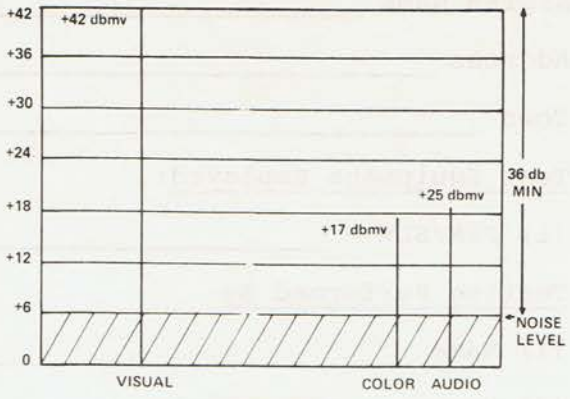


DIAGRAM 3

Steps:

(1) This measurement must be made at a fairly *high* signal level measurement point in the system. The levels shown in Diagram 3 are *not* absolute; (i.e. they are intended to show that you need from 36 to 42 db *more signal* at the measurement point *than* the *system noise* which is what you are going to measure to make a valid measurement). It may *not* be possible to make this measurement *accurately* with some FSM/SLM devices unless the true (absolute) input level to the FSM/SLM is in the +10 dbmv or higher range.

This measurement can be made at the *output* test point port on a line extender or through a low isolation value DT (i.e. 8 or 12 db) inserted for test purposes directly after the amplified output (port) of a line extender amplifier.

(2) This measurement must be *repeated for all channels* on the system which meet the Class I, Grade B criteria.

(3) On *each* channel:

(A) Determine the *absolute level* of your visual carrier high level test point; note this level on your measurement form.

(B) Leaving the FSM/SLM untouched, radio, call, or signal the head end and have the antenna input signal to the processing equipment disconnected; *replace the input cable* with a 75 ohm terminating resistor (see Diagram 4).

Note: If, in the absence of input signal, your signal processor turns on a standby carrier, this standby carrier *must be disabled* for this test.

(C) Now remove pad attention from the FSM/SLM until your FSM/SLM be-

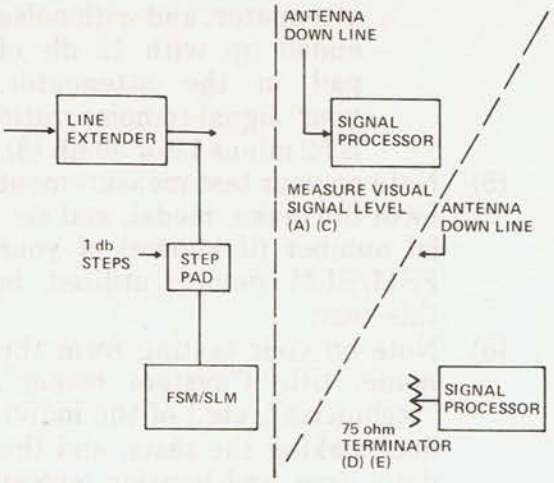


DIAGRAM 4

gins to read on-scale once again. *What you are now measuring*, with the input signal disconnected and the processor input terminated but the processor still running, *is cumulative noise* on the channel being measured. Note the *absolute level* of that noise as read out from your FSM/SLM. The *numerical difference* between the signal level read when the antenna was connected to the processor and the signal level (i.e. noise level) when the signal was disconnected and replaced with a terminator *is your system signal to noise ratio* (3) for that channel. Note the noise level in absolute level *and* the signal to noise level (i.e. signal reads +36 dbmv, noise reads -4 dbmv; signal to noise is +36 dbmv minus -4 dbmv, or 40 db signal to noise) on your measurement form.

(4) There is an alternate method of performing this test, if you have reason to be suspicious of your FSM/SLM switchable pads:

(A) At your high level test point, open the FSM way up (i.e. *take all attenuation out*) and before you connect the FSM/SLM to the test point, place a 1 db step attenuator (with all attenuation in) between the FSM/SLM and the test point.

(B) Take attenuation out of the external 1 db step attenuator until you have a convenient *reference* scale *reading* (such as mid-scale or 0 db);

(C) Peak the FSM/SLM out of more time on the visual carrier frequency, and *leave the frequency tuning knob untouched;*

(D) Direct the head end to *disconnect* the antenna input, *replacing it* with a 75 ohm terminator at the processor input; make certain that the processor runs normally, with *no* standby carrier operating.

---

3) It is necessary to compensate for the narrower bandwidth of the FSM/SLM device when measuring signal-to-noise ratios for a 4.5 MHz bandwidth TV signal. Therefore, determine what the "bandwidth compensating number is" for your particular FSM/SLM (consult your manual), or take 4.0 db to be safe, and if you measure 40 db signal-to-noise in the test, subtract either the known compensation number, or 4.0 db as a maximum, to arrive at the compensated value for the test results.

(E) Now make a note of the number of db of attenuation *remaining in the external 1 db step attenuator*, and start taking *out* attenuation until the FSM/SLM comes *back* to your convenient reference point set in (B) above on noise alone.

(F) The *number of db which you took out* of your external attenuator to bring the FSM/SLM back to the *same scale* reference point as in (B) above is your signal to noise ratio (3). If you began with 52 db of pad in the external attenuator, and with noise ended up with 12 db of pad in the attenuator, your signal-to-noise ratio is 52 minus 12 or 40 db (3).

(5) Note on your test measurement form the make, model, and serial number (if known) of your FSM/SLM device utilized in this test;

(6) Note on your testing form the name, title ("system owner", "technician", etc.) of the individual making the tests, and the date, time, and location (street address) of the tests.

SIGNAL TO NOISE RATIO TEST LOGGING FORM - A

SYSTEM NAME _____

Address _____

Town _____ State _____ Zip _____

Test Equipment Employed:

(1) FSM/SLM _____ S/N _____
(2) Other _____ S/N _____

Testing Performed By:

(1) _____

(2) _____

Location Number One: _____
Location Number Two: _____
Location Number Three: _____

SIGNAL TO NOISE RATIO TEST LOGGING FORM - B

Chan.	#1/V	#1/N	#1/S-N	#2/V	#2/N	#2S-N	#3/V	#3/N	#3S-N	
2	____	- ____	= ____	____	- ____	= ____	____	- ____	= ____	(see note 1)
3	____	- ____	= ____	____	- ____	= ____	____	- ____	= ____	(see note 1)
4	____	- ____	= ____	____	- ____	= ____	____	- ____	= ____	(see note 1)
5	____	- ____	= ____	____	- ____	= ____	____	- ____	= ____	(see note 1)
6	____	- ____	= ____	____	- ____	= ____	____	- ____	= ____	(see note 1)
7	____	- ____	= ____	____	- ____	= ____	____	- ____	= ____	(see note 1)
8	____	- ____	= ____	____	- ____	= ____	____	- ____	= ____	(see note 1)
9	____	- ____	= ____	____	- ____	= ____	____	- ____	= ____	(see note 1)
10	____	- ____	= ____	____	- ____	= ____	____	- ____	= ____	(see note 1)
11	____	- ____	= ____	____	- ____	= ____	____	- ____	= ____	(see note 1)
12	____	- ____	= ____	____	- ____	= ____	____	- ____	= ____	(see note 1)
13	____	- ____	= ____	____	- ____	= ____	____	- ____	= ____	(see note 1)

NOTE ONE: Following steps given in text, measure video signal level on Class I signals received within their grade B (or better) contour only, at three test locations and enter visual carrier level reading under "#1/V" (and #2/V, #3/V). Then make noise level measurement per text and enter under "#1/N" (and #2/N, #3/N). Calculate the difference in DB level between the visual carrier and the noise level, and enter under "#1 S-N" (and #2 S-N, # 3 S-N).This becomes the uncorrected S-N ratio.

NOTE TWO: The correction factor for your FSM/SLM, depending upon i.f. bandwidth is _____db (enter 4.0 db if unknown); therefore all readings are ____db (same just entered) lower than those shown in #1(2)(3) S-N entered above.

Make measurements only on signals received first within the predicted Grade B contour; ignore signals beyond Grade B and local origination channels on the system.

Date Tests Performed: (1) _____(2)_____(3)_____

Qualifications: _____

Signature Individual Doing Tests: _____

76.605 (a) (12)

This is the system radiation test required for all systems, *regardless of age*. This measurement is supposed to determine to your satisfaction that *any* signal leakage from your system does *not exceed* the prescribed maximums set by 76.605 (a) (12), at any point in the system. This is not, literally, a measurement which can be made at three distinct points in the system (see CATJ for November, *Measurements*). *At how many points* you make this measurement is entirely up to you, although *you cannot escape the responsibility* that your *whole system shall be free of radiation* in excess of the prescribed maximum.

As a practical matter, system radiation can take place (1) along trunk or distribution lines, where broken or severed outer cable conductors are found, (2) along trunk or distribution lines where connectors are improperly seated into an amplifier, line splitter, tap, terminator, etc., (3) at power supply (voltage) insertion points where AC/RF isolation has failed and signal is radiated by the power supply, power insertion device, or by the AC wiring between the power mains secondary and the AC power input to the power supply, (4) at and along subscriber drops where cable shielding is inadequate, broken or rubbed through, (5) and at the terminus of subscriber drops where a subscriber has left a line unterminated and perhaps touching some metallic object which, in turn, is re-radiating the signal in the area. Radiation can also take place when a cable drop is connected to a receiver antenna terminals (through a matching transformer) and the customer parallels the cable connection to his receiver with his own outdoor antenna. This feeds the cable RF voltages right back up to the rooftop antenna, and it radiates over the neighborhood. This is *not* the cable's fault, but *it is up to you* to spot and see that it is corrected.

Section 76.605 (a) (12) reads (in part) *"Radiation from a cable television system shall be limited to 20 microvolts per meter between 54 and 216 MHz at a distance of ten feet"* and "15 microvolts per meter at a distance of 100 feet for frequencies below 54 MHz and above 216 MHz".

Microvolts per meter is a strange measurement term to most CATV operators. It does not mean "microvolts at a distance of a meter" or "microvolts per FSM"! The translation of "microvolts per meter" to "microvolts I can measure on my handy 75 ohm reference dipole" is shown here in Table One.

TABLE 1

To determine the maximum permissible radiation level from your system, select from this table the frequency of the channel to be measured in the radiation tests (visual carrier given for TV channels). The levels permitted following test steps given here are shown in microvolts and in dbmv levels. If an amplifier is used **between the test dipole and the FSM/SLM,** its known **gain** must be **added** to the levels given here. Feedline loses between the dipole and the FSM must also be **added** to levels measured (i.e. if there is 1 db of feedline loss, this is 1 db **less real signal** you can measure and still meet the spec).

Channel/ Frequency	Microvolts	dbmv
2	15.65	– 36
3	14.20	– 37
4	12.90	– 38
74 MHz	11.70	– 39
5	11.20	– 39
6	10.40	– 40
100 MHz	8.65	– 41
108 MHz	8.05	– 42
165 MHz	5.25	– 46
7	4.95	– 46
8	4.80	– 46
9	4.65	– 47
10	4.50	– 47
11	4.35	– 47
12	4.22	– 48
13	4.10	– 48

Steps:

(1) Construct a 75 ohm reference dipole, following your own techniques or by following Diagram 5. The dipole should be adjustable (for frequency), which means that the A-B and C-D rods should be adjustable for length. You can do this very simply by procuring replacement telescopic rod walkie-talkie antennas or TV "rabbit ear" antennas, which utilize slip-together rods concentrically. The total A-B/C-D length(s) must be set (per Table 2) for each channel.

(2) The dipole antenna must be elevated to approximately the height of the CATV line(s) being "probed" for radiation. This suggests that a wooden (i.e. insulated in case of accidental contact to AC power lines) handle of some length (10-12') is required.

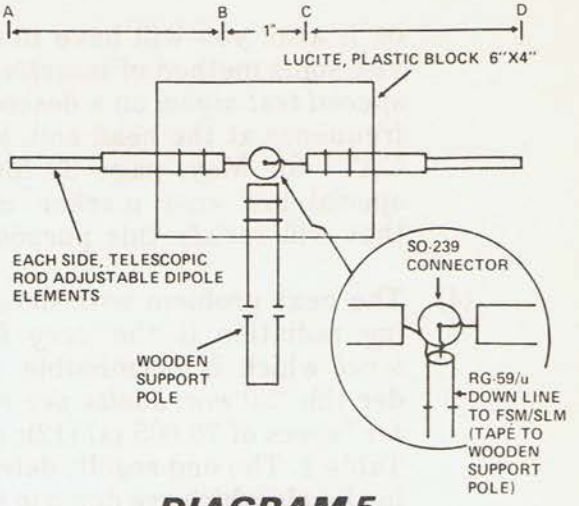


DIAGRAM 5

(3) The FSM is adjusted to the exact frequency of the carrier for which you are probing. Here you may have a practical problem. Unless you have unreal *amounts of radiation*, your chance of finding true plant radiation, while walking along the ground is slim because your dipole antenna is going to pick up *direct TV signals from transmitters* within 100 miles or so. Therefore, you should *select a TV channel which has no VHF station* on it within say 100 miles or more (such as cable channel occupied by a UHF station); or, *select a frequency that is cable utilized*, such as your pilot carrier 72-76 MHz or 165 MHz or 216-220 MHz signal. By selecting a cable-carrier for probing which is *not going to conflict* with signals floating around in the air, you stand a better chance of finding radiation and not spending the day chasing down off-the-air signals. If you have no pilot carrier and every channel on your system has off-the-air broadcasters

TABLE 2

Dipole lengths for each half of the dipole antenna are given here. The A-B and C-D distances are identical (i.e. both sides are the same) and the length must be adjusted before measurements are made on a specific frequency or channel. See Diagram 5.

Channel	A–B / C–D
2	50.1" each
3	45.2" each
4	41.2" each
74 MHz	37.4" each
5	35.9" each
6	33.3" each
100 MHz	27.7" each
108 MHz	25.6" each
165 MHz	16.8" each
7	15.8" each
8	15.3" each
9	14.8" each
10	14.3" each
11	13.9" each
12	13.5" each
13	13.1" each

on it also, you will have to devise some method of *inserting a special test signal* on a descrete frequency at the head end. See CATJ for May, page 32 for a special low cost marker unit that will satisfy this purpose.

(4) The next problem with detecting radiation is the *very low level* which is permissible under the *"20 microvolts per meter"* specs of 76.605 (a) (12); see Table 1. The end result, detecting levels which are down in the -40/-50 dbmv region, is difficult *even with first rate FSM/SLM devices.* If you are operating with measurements of a descrete cable-secure frequency (i.e. a pilot carrier or test carrier inserted at the head end), you can at least avoid false readings from off-the-air signals that may come floating into the dipole-FSM/SLM combination.

One solution is to employ a package such as the MID-STATES COMMUNICATIONS (4) model RD-1, a combination dipole for measurements and 20 db flat gain amplifier which gives all signals picked up *20 db "boost"* thereby making accurate FSM/SLM low level measurements possible. With such a unit in use, your *real* level becomes 20 db *lower* than your meter-read-level, of course.

(5) With all of these problems under control, take the dipole and probe *"10 feet above the ground and directly below the* (cable) *system components".* Where vertical clearances between the cable and the ground is less than 20 feet, *"lower the test dipole so that it is ten feet sepration from the cable system components".* With the dipole in position, *"rotate the dipole at the measurement height in a vertical axis until you obtain maximum meter reading".* And finally, *"if there are other conductors* (i.e. down guys, etc.) *within ten feet the measurement antenna, find another location for your tests; one such that no other conductive materials* (i.e. metallic) *are within ten feet of the test antenna".*

(6) Note the readings found, and having ascertained that there are *no locations in town where your plant radiates beyond the prescribed maximums;*

(1) Note in your test measurement form the make, model and serial number of any equipment utilized in this test;

(2) Note on your test form the name, title ("system owner", "technician", etc.) of the individual making the tests, and the date, time and *locations* where tests were conducted.

This completes the tests required to have been made *initially* on or before March 31, 1974, and which must be *repeated again* on or before March 31, 1975, by all grandfathered systems. Additionally, grandfathered systems must also complete the following *new* (this year) *tests* on or before March 31, 1975.

---

4) MID-STATE Model RD-1 combination test dipole and 20 db gain flat amplifier sells for $166. Contact Mid-State Communications, P.O. Box 203, Beech Grove, Indiana 46107.

RADIATION TEST LOGGING FORM

SYSTEM NAME _____

Address _____

Town _____ State _____ Zip _____

Test Equipment Employed:

(1) FSM/SLM _____ S/N _____
(2) Test Dipole _____ S/N _____
(3) Dipole Amplifier _____ S/N _____
(4) Other _____ S/N _____

Tests Performed By:

(1) _____
(2) _____

Short Form Compliance:

"I hereby certify that employing the technique outlined below this CATV system has been checked for signal radiation per the specifications of 76.605 (a) (12) and no radiation in excess of the limits prescribed have been found: (description of technique) - _____
_____
_____
_____
_____"

Signature - _____

Long Form Compliance:

(1) Test location 1 _____
(2) Test location 2 _____
(3) Test location 3 _____
(4) Test location 4 _____
(5) Test location 5 _____
(6) Test location 6 _____

Maximum Radiation found (ch. #)	# one	# two	# 3	# 4	# 5	# 6
Ch. _____	___db	___db	__db	__db	__db	__db (mv)

"I hereby certify that measurements made at the above noted locations indicate this CATV system has compliance with 76.605 (a) (12) radiation specifications, following procedure described here: _____
_____
_____"

Date of tests: _____ Signature - _____

This is the "hum modulation" measurement. Essentially, what you are setting out to determine is that the percentage of hum (from the AC mains power) induced into the RF signals *does not exceed* a modulation index of 5% on the RF signal(s) present. To put it another way, you are trying to ascertain whether or not AC hum, caused by the sine-wave AC power mains source, is getting into the RF (radio frequency) signals, and causing some percentage of *objectional AM* (amplitude) *modulation to the video* (picture portion) *signals.*

Section 76.605 (a) (7) states *"The peak-to-peak variation in visual signal level caused by undesired low frequency disturbances* (hum or repetitive transients) *generated within the system, or by inadequate low frequency response, shall not exceed 5% of the visual signal level".*

In plain English, is the hum so bad that people *object* to it?

Hum modulation can get into a system at any point where AC power is introduced to equipment that handles the signal. It can even come from directional taps that pass both AC and RF! However, it normally comes from an inadequately filtered power supply; and, since no manufacturer could reasonably expect to peddle equipment that hum-modulated RF signals by 5% (or more), we must assume that if we have hum modulation on our pictures, *something has broken down* in the equipment during service-useage.

A 5% hum modulation maximum (limit) is very *generous* of the FCC. This amounts to a modulating signal that is 26 db lower in level than the desired video signal; and most of us recognize that *a 26 db ratio* between (say) desired signal and noise, or desired signal and co-channel *is objectionable.*

The plain facts are that while section 76.605 (a) (7) states "(hum)... *shall not exceed 5%...*", if any of the RF carriers in our system even *approach* 5% hum modulation in real life, our cable office phone rings off the hook (or nobody is watching that channel!).

If the purpose of testing is to *determine compliance* with the rules, then making compliance with 76.605 (a) (7) is very simply done. *"Turn on a TV set at the test measurement point, and switch through the channels. Do you see any 60 cycle hum bars in the picture?"* If you do, but they are *very* faint, you are well *under* 5% hum mod. If they *are objectionable*, you are approaching 5% or exceeding it. It sounds like a very *"subjective"* kind of test analysis, and truthfully, it is. This type of interference is *not* one on which differently calibrated eyeballs read different results. Virtually *anyone* can spot 60 cycle hum bars in the picture, and *if you can't see them there*, you are just as certain you are *under* 5% hum mod limits as you would be after setting up a scope to make a test.

What CATJ is suggesting is that 76.605 (a) (7) compliance can be made by most systems by giving it a *"subjective eyeball test"*. Then *if* you are *"seeing hum"* you should proceed on with the more critical test to be described here. It should be noted that this kind of subjective (eyeball) testing *is under serious consideration* by the C-TAC panel (Panel 2) and that pending the final results of C-TAC Panel 2, the Commission is "holding pat" on two *other* measurement areas which require equipment more sophisticated (and expensive) than the average quality FSM/SLM.

Steps:

(1) Set up test setup as shown in Diagram 6. A relatively high level test point is required. *You must make this measurement on a carrier on the system that has no normal modulation* (i.e. not a TV carrier, although a standby carrier could be used). This could be an unmodulated pilot carrier, or a special AØ (unmodulated) test oscillator inserted at the head end. Your purpose is to determine if the unmodulated carrier has any (hum) modulation present (5).

(2) Set the FSM/SLM to the frequency of the AØ (*unmodulated*) carrier. Connect the *video output jack* on the FSM/SLM to the *vertical input* of a *DC coupled scope* with moderately good sensitivity (at least down to 50 millivolts per division). *Note: Do not attempt to make this measurement without a CD coupled scope.* Bypass the vertical input jack on the scope with a *.02 uF disc capacitor to the scope chassis ground* to insure no *locally* induced hum goes into the vertical input. Operate the FSM/SLM on its *battery supply* to eliminate that possibility of hum introduction.

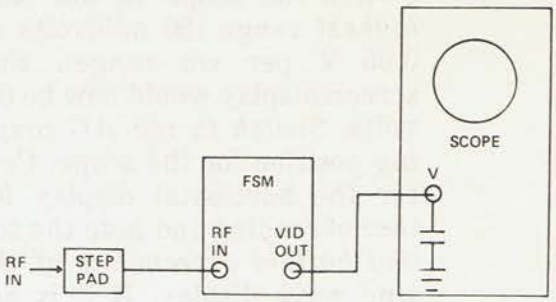


DIAGRAM 6

(3) See Diagram 7. Set the scope to AC line sync (60 cycles); set the scope to DC. Set the scope to 0.1 V per cm range. Adjust the vertical centering of the scope for a straight line *resting even with the bottom graticule* on the scope screen (this assumes a scope screen graticule of 10 cm for the grid display, which is common). This is 7A.

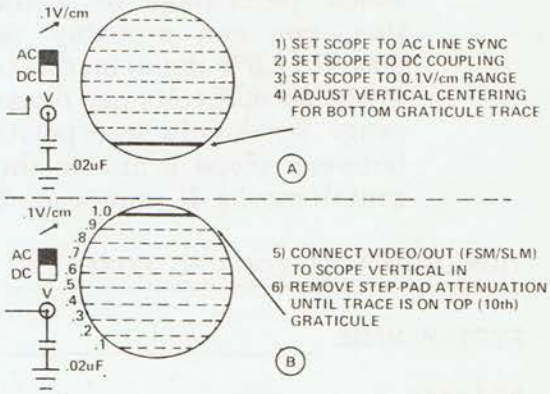


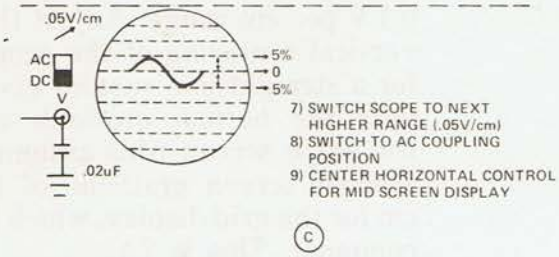
DIAGRAM 7

(4) Now connect the output of the FSM/SLM *video-out jack* to the *vertical input* of the scope. Adjust the in-line pad, manual gain or IF gain control on the FSM/SLM to produce a horizontal line that centers across the *top* (tenth) graticule line on the scope screen. This is 1 volt signal to the scope from the FSM/SLM. See 7B.

---

5) *Any unmodulated carrier which you insert on your system, or make use of if already there (i.e. pilot carrier), to check for the presence of hum modulation must be clean of any hum modulation itself. If the power supply for a pilot carrier (for example) is not adequately filtered, and the result is a hummy pilot carrier, this test cannot be conducted until the test carrier is itself clean of hum at the head end before it goes into the plant distribution system.*

(5) Switch the scope to the next *highest* range (50 millivolts or 0.05 V per cm range). Full screen display would now be 0.5 volts. *Switch to the AC coupling* position for the scope. Center the horizontal display for ease of reading and note the *top and bottom extremities of the* sine wave display. If it is *not more* than two graticule divisions high (on a ten division screen, see Diagram 7C), *you are 5% or less* hum modulated on the AØ carrier.



(6) If you wish to measure the *absolute* percentage of modulation, you can probably read down to 2.5% (hum) modulation in the 50 millivolts per division range by simply interpolating between scope graticule (horizontal) marks. If your scope has a 25 millivolts per division (.025 V/cm) range, this would expand the visual scale *from two divisions height for 5%* modulation to *two divisions height for 2.5% modulation.*

NOTE: Your FSM/SLM may not have a 1 volt peak-to-peak output level ability in the video output jack. The Jerrold 727, for example, is 0.8 volt peak to peak, while the Delta-Benco FST-4 is 0.5 volt peak-to-peak. These specs are for a *full scale* (i.e. *meter* scale) *reading however*, and since we are *not* really interested in the *real level* through the FSM/SLM but are interested only in a full scope display, to get 1 volt p/t/p out of a unit that has a lower *rated* output, simply run the instrument at some *input attenuation-OUT level* which produces the 1 volt video output required for step (3) here.

(7) Note on your test measurement form the make, model, and serial number (if known) of any equipment utilized in the test.

(8) Note on your test form the name, title ("system owner", "technician", etc.) of the individual making the tests, date, time and location where the tests were conducted.

HUM MOD TEST LOGGING FORM - A

SYSTEM NAME _____

Address _____

Town _____ State _____ Zip _____

Test Equipment Employed:

(1) FSM/SLM _____ S/N _____
(2) DC Coupled Scope _____ S/N _____
(3) Carrier (AØ) Signal Generator _____ S/N _____
(4) Other _____ S/N _____

Tests Performed By:

_____

HUM MOD TEST LOGGING FORM - B

Location Number One: _____
Location Number Two: _____
Location Number Three: _____

Qualifications of individual doing tests:

_____
_____
_____

Short Form Compliance:

"I hereby certify that I have inspected the television pictures at the three locations described above, and based upon my experience and qualifications, I find no objectional video disturbances from hum modulation in the Class I pictures at these locations".

Signature - _____

Long Form Compliance:

Description of test set up and technique - _____
_____
_____
_____

Channel	Location # 1 / Hum %	Location # 2 / Hum %	Location # 3 / Hum %
2	____%	____%	____%
3	____%	____%	____%
4	____%	____%	____%
5	____%	____%	____%
6	____%	____%	____%
7	____%	____%	____%
8	____%	____%	____%
9	____%	____%	____%
10	____%	____%	____%
11	____%	____%	____%
12	____%	____%	____%
13	____%	____%	____%

Date of tests: (1) _____ (2) _____ (3) _____

Signature individual doing tests - _____

76.605 (a) (8)

This is the measurement of the "in channel response" of each Class I (off-the-air) signal utilized on the system.

This section states *"The channel frequency response shall be within a range of +/— 2 decibels for all frequencies within -1 MHz and* +4 MHz of *the visual carrier frequency."*

See Diagram 8. A single television channel is 6.0 MHz wide. Within that 6.0 MHz bandwidth, the *visual carrier frequency* is 1.25 MHz *above* the lower channel edge. The *color sub-carrier frequency* is 4.83 MHz *above* the lower channel edge, and the *aural carrier frequency* is 5.75 MHz *above* the lower channel edge (and 0.25 MHz below the upper channel edge). Section 76.605 (a) (8) states that *"within -1 MHz and +4 MHz the processed channel shall be gain-flat within +/— 2 db"*. See Diagram 8B and 8C. What we are really protecting with the +/—2 MHz flatness spec is the video modulation region of the channel. In *theory*, the lower (AM) sideband of the TV transmission (i.e. that portion below the visual carrier frequency) is *filtered out at the transmitter* (in something called a Lower Vestigal Sideband Filter) and the *contribution* to the reproduced television picture on the TV receiver of any of the modulation energy that is *below* (in frequency) *the visual carrier frequency* is questionable at best. However, the requirement *at the present time* (6) is that we maintain processing flatness to a point -1 MHz below the visual carrier frequency, plus or minus 2 db.

To measure our "in-channel" flatness, we have to determine first of all from *where we start measuring*. The FCC has not yet defined the "input test point" (6), but it appears logical that they will do so *soon* and that it will be "the input to the signal processor unit"

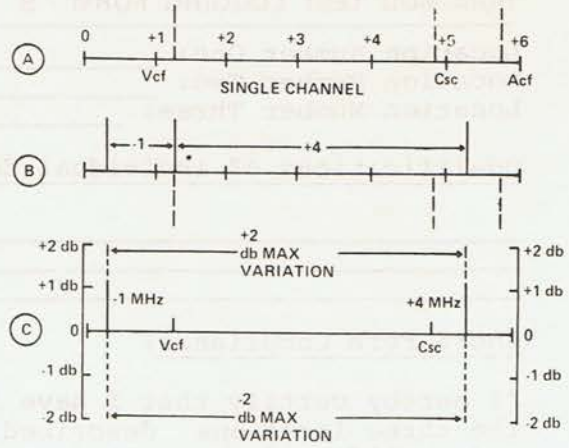


DIAGRAM 8

when the CATV system has hard performance data available on the bandpass characteristics of *any and all frequency selective equipment appearing before the processor input.* This would usually *include* the bandpass characteristics of *any and all frequency selective equipment appearing before the processor input.* This would usually *include* the bandpass characteristics of the antenna, a pre-amplifier if one is used, and any bandpass filters or traps that are external to the processor unit.

For our purposes here we are considering the input test insertion point to be *the input to the processor.* See Diagrams 9, 10, 11, and 12.

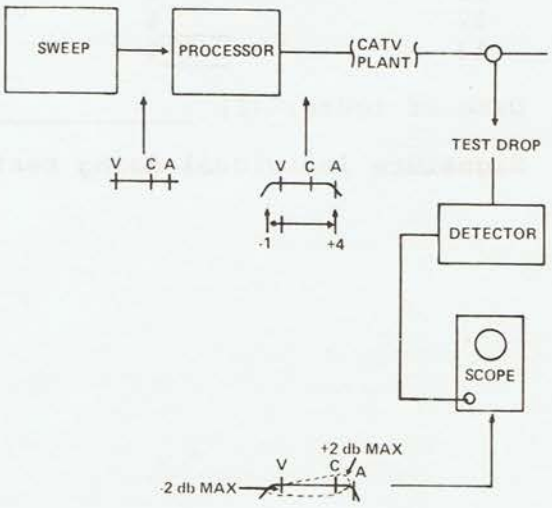


DIAGRAM 9

Steps:

(1) Some type of flat reference signal must be inserted *into the processor input.* This can be a *sweep* (Diagram 9), a wideband *noise generator* (Diagram 10), a 1 MHz *comb generator* (Diagram 11), or a tuneable frequency-accurage *signal generator* (Diagram 12).

The procedure is to insert the flat reference signal into the processor input, and then *go down the line* to your test measurement point and see whether the flat input has become *tilted more than +/— 2 db* at any point *between* the visual carrier frequency -1 MHz and the visual carrier frequency +4 MHz.

While it is possible that some degree of tilting *might* take place cumulatively between the *output of the head end* and the plant output at your test measurement point (i.e. *within* the trunk and distribution portion of the plant itself), it is *extremely unlikely* that it would ever accumulate to more than +/— 2 db. Keep in mind the plant is the *"picture of broadband flatness"*, and that even variations which may creep in are seldom abrupt *within* a 6 MHz bandpass area, even on a cumulative basis.

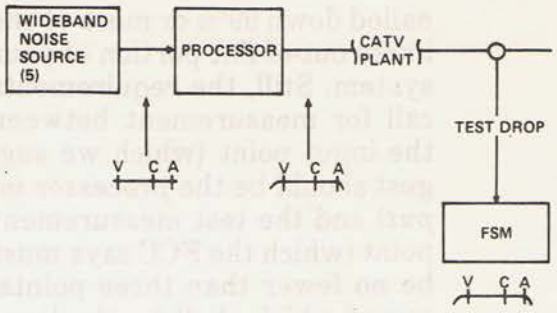


DIAGRAM 10

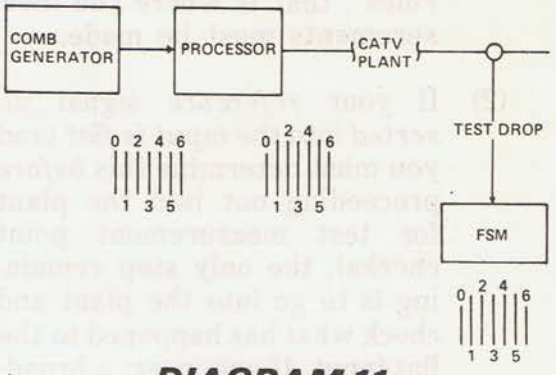


DIAGRAM 11

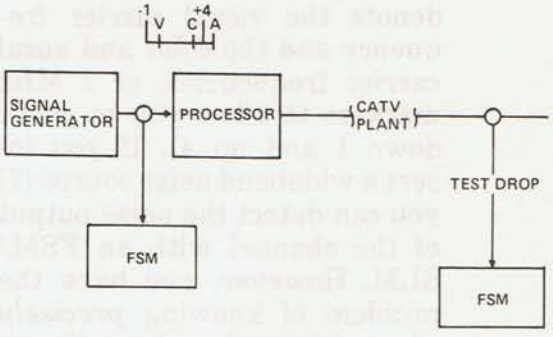


DIAGRAM 12

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(6) The FCC advised CATJ late in December that 76.605 (a) (8) will be modified during January 1975 to state that, "The channel frequency response shall be within a range of +/— 2 db for all frequencies —0.75 MHz and +4.0 MHz of the visual carrier frequency." This is a change from the "—1.0 db and +4.0 MHz" currently stated in the rules. Your 1974/75 measurements should be made according to the new change specifications.

The most likely spot for *"tilt"* of the processed channel to occur is in the headend signal processing equipment. This suggests that if you insert a *flat reference signal* at the input to the processor, and then measure how much "out of flat" it has become at the output of the head end, that you will have

nailed down 99% or more of the likely out-of-flat portion of your system. Still, the requirements call for measurement between the input point (which we suggest should be the *processor input*) and the test measurement point (which the FCC says must be no fewer than three points, one of which shall be the longest system drop by cable distance from the head end); to comply with the "letter of the rules", that is where the measurements must be made.

(2) If your *reference* signal *inserted* into the *input is flat* (and you must determine this *before* proceeding out into the plant for test measurement point checks), the only step remaining is to go into the plant and check what has happened to the flat input. If you insert a broadband sweep at the head end (Diagram 9), detect that sweep and display it (with markers to denote the visual carrier frequency and the color and aural carrier frequencies, or 1 MHz markers to allow you to count down 1 and up 4). If you insert a wideband noise source (7) you can detect the noise output of the channel with an FSM/SLM. However, you have the problem of knowing *precisely* where "down 1 and up 4" are with a noise source, since most FSM/SLM devices cannot be that accurately, as frequency readout devices. You also have the problem of separating that specific channel of noise from adjacent channels of signal. Your noise source must be at least 0 dbmv into the processor, and +10 dbmv is better yet, to assure proper output level (i.e. normal output is required) from the processor. If you insert 1 MHz combs from a comb generator (Diagram 11), you have a built-in frequency marking device which you can display (i.e. read out) on an FSM/SLM or on a spectrum analyzer. If you use a comb generator, the FSM/SLM is set to the *visual carrier frequency* with the TV signal being processed, then the comb generator is *substituted* for the normal input at a 0/+10 dbmv comb level. Slowly tune the FSM/SLM *down in frequency* (About 0.25 MHz) until you come to the first "comb carrier". This is now visual carrier frequency (Vcf) *minus* 0.25 MHz, and the *next* one down will be the Vcf minus 1.25 MHz. If it is within the +/— (and it should be *minus*) 2 db spec, you are *0.25 MHz to the good* with your low side roll off. The same procedure counting *up* will get you the Vcf *plus* 4 MHz, and it (as well as all in between) should also be +/— 2 db from the comb that was 0.25 MHz below the true Vcf. Finally, if you use a tuneable signal generator for your test input signal source, adjust it, *on the visual carrier frequency*, to +10 dbmv output to match the normal processor input level, and make *certain* the processor output level is "normal". Read the signal level on the FSM/SLM at the *test measurement* point. Then dial the signal generator to a frequency that is 1 MHz *lower* (i.e. Vcf -1 MHz) than the

---

7) Wideband noise sources are available from SADELCO (299 Park Avenue, Weehawken, N.J. 07087) and VITEK (200 Wood Avenue, Middlesex, N.J. 08846).

visual carrier, and determine that the level *to the processor* is unchanged from the Vcf *input* level inserted. Measure that level on your FSM/SLM at the *test measurement point* (it should be +/− 2 db and will probably be minus). Now go back to *Vcf plus 1 MHz* and repeat the test, again being sure the signal generator output is identical to the same generator output (i.e. *same as processor input*) as you ran on the Vcf. Read and note the level at the test measurement point. *Repeat* the test at *Vcf plus 2 MHz*, *Vcf plus 3 MHz*, and *Vcf plus 4 MHz*. Note the results with each test;

(3) Recall that this "in channel flatness test" must be repeated for *every* channel which you first pick up within the Grade B (or higher grade) signal contour.

(4) Note on your test measurement form the make, model, and serial number of any test equipment employed in the tests;

(5) Note on your test form the name, title ("system owner", "technician", etc.) of the individual making the tests, and date, time, and location where the test measurements were made;

(6) *NOTE:* Because we have chosen to *insert* the test (flat) reference signal *at the processor input*, we must also make numerical allowances for *any frequency selective equipment* preceding that input point. This requires that you have *in your files* flatness data *from the manufacturer* of any antenna, pre-amplifier, filters, etc. which may be inserted into the line *ahead* of the processor. In the event that your tests show you are -1.5 db at (for example) minus 1 MHz, *between the processor input and the test measurement point*, and your cumulative antenna and preamp flatness data shows you are minus *another 1.0 db* at minus 1.0 MHz (reference Vcf), then your whole in-channel flatness spec becomes -1.5 plus -1.0 or a *true minus 2.5 db*. This would be *out of spec* with 76.605 (a) (8). Data relating to the whole package of equipment *must* be a part of your test measurement form data.

IN CHANNEL FREQUENCY RESPONSE TEST LOGGING FORM - A

SYSTEM NAME _____

Address _____

Town _____ State _____ Zip _____

Test Equipment Employed:

(1) FSM/SLM _____ S/N _____ ; Sig Gen _____ S/N _____
(2) Sweep Gen _____ S/N _____ ; Detector _____ S/N _____
(3) Scope _____ S/N _____ ; Comb Gen _____ S/N _____
(4) Wideband Noise Source _____ S/N; Other _____

IN CHANNEL FREQUENCY RESPONSE TEST LOGGING FORM- B

Tests Performed By:

(1) _____
(2) _____

Qualifications of individual doing tests:

_____
_____

Short Form Compliance:

"I hereby certify that tests required by section 76.605 (a) (8) have been performed on this system, following the procedure outlined below, and channels where +/- 2 db compliance, from 0.75 MHz (minus) to 4.0 MHz (plus) the carrier frequency of Class I channels is not met are listed below:(description of procedure) _____
_____
_____".

Channel not meeting compliance: _____,_____,_____,____ (if none, so state).

Signature - _____

Location Number One: _____
Location Number Two: _____
Location Number Three: _____

Long Form Compliance:

Channel	# 1 Variation	at MHz	# 2 Variation	at MHz	# 3 Variation	at MHz
2	____db	_____	____db	_____	____db	_____
3	____db	_____	____db	_____	____db	_____
4	____db	_____	____db	_____	____db	_____
5	____db	_____	____db	_____	____db	_____
6	____db	_____	____db	_____	____db	_____
7	____db	_____	____db	_____	____db	_____
8	____db	_____	____db	_____	____db	_____
9	____db	_____	____db	_____	____db	_____
10	____db	_____	____db	_____	____db	_____
11	____db	_____	____db	_____	____db	_____
12	____db	_____	____db	_____	____db	_____
13	____db	_____	____db	_____	____db	_____

NOTE: Show maximum measured variation only, with approximate frequency (in MHz) of that variation, on Class I channels only. Indicate whether variation is plus (+) or minus (-) for each channel at each location.

Date of tests: (1) _____ (2) _____ (3) _____
Signature individual doing tests - _____

This is the "isolation between subscriber terminals" measurement. This section specifies a specific number (18 db), but it also notes that in case *"18 db is not adequate isolation"* that *"isolation. . . shall be sufficient to prevent reflections caused by open-circuit or short-circuited subscriber terminals"* causing picture degradation at any other subscriber terminal.

The section reads, *"The terminal isolation provided each subscriber shall be not less than 18 decibels, but in any event, shall be sufficient to prevent reflections. . . from producing visible picture impairments at any other subscriber terminal."*

Most passive devices (directional taps in particular) manufactured since 1969 have *no* difficulty meeting and exceeding this spec by a wide margin. Most splitter devices manufactured since that period, and more especially the hybrid splitter devices, have no problem with that spec. Older directional taps and non-hybrid splitters of that earlier vintage, or even more recent vintage, may have some problems here.

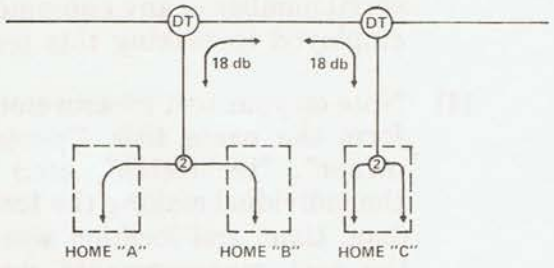

DIAGRAM 13

See Diagram 13. Between any two subscribers, there must be *at least* 18 db of terminal isolation. It is also *likely* that the Commission *intended* that between *any two terminals*, even if they are for a *single* subscriber, there shall be no less than 18 db terminal isolation

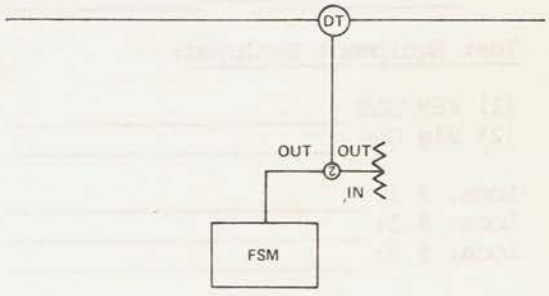

DIAGRAM 14

(although the rules *are* unclear on this point). Two-way (Four-way, etc.) splitters are easily checked as shown in Diagram 14. The normal tap connections are reversed so that the *input is terminated* and the drop signal coming to the house is connected to *one* of the output ports. The FSM is connected to the *other* output port (in the case of a two-way device) and the absolute level is read on the FSM/SLM. This is compared with the absolute level measured at the terminus of the drop (at the *input* to the splitter) and it should be down 18 db or more. In this situation, we are using the *drop level signal voltage* as our *reference* level, thereby avoiding hauling in a signal generator.

A directional tap installed on the distribution cable cannot be easily checked in this fashion since you cannot easily disconnect the tap from the line. The best method of checking the DT is to go to "Home A" and hook-up a signal generator at the terminus of the tap, feeding a signal generator carrier (on some *non-TV* frequency such as within the FM band) *into* the tap drop cable. Then go to *another* home ("Home B") connected to the *same* DT and hook the FSM/SLM to the end of that drop terminus (Diagram 15). Measure the signal level present, *referenced against the signal level fed into the drop terminus* at "Home A". It should be down at least 18 db. Yes, the

ISOLATION TEST LOGGING FORM

SYSTEM _____
Address _____
Town _____ State _____

Test Equipment Employed:

(1) FSM/SLM _____
(2) Sig Gen _____

Loca. # 1: _____
Loca. # 2: _____
Loca. # 3: _____

Tests Performed By:

(1) _____
(2) _____

Qualifications:

_____
_____

Description Test Set Up/Technique:

_____
_____
_____

Location # 1 -

Minimum Isolation of _____db at a frequency of _____MHz;

Location # 2 -

Minimum isolation of _____db at a frequency of _____MHz.

Location # 3 -

Minimum isolation of _____db at a frequency of _____MHz.

Date of Tests:

(1) _____
(2) _____
(3) _____

Signature Individual Doing Tests:

_____

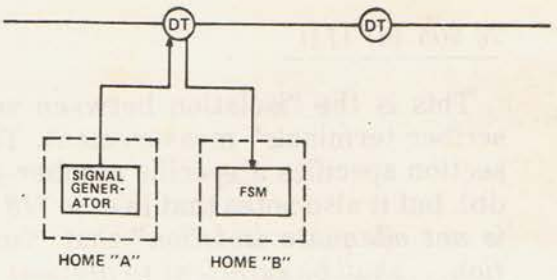

DIAGRAM 15

combined drop cable losses *add* to the isolation of the DT in this case, and *this is perfectly acceptable* as a *part* of the total isolation between "Homes A and B"; for purposes of Section 76.605 (a) (11).

Steps:

(1) Connect a known reference signal, from either the cable system or from a signal generator, to one *output* port of a two (or more) port passive device;

(2) Connect an FSM/SLM to another *output* port on the same device, and measure the signal level present;

(3) Note on your test measurement form the make, model, and serial number of any equipment employed in making this test;

(4) Note on your test measurement form the name, title ("system owner", "technician", etc.) of the individual making the tests, date, time, and location where the test measurements were made.

SUMMARY

This completes the test measurements required for all grandfathered systems for the 1974/1975 year. These measurements *must be completed* and in your files before midnight March 31, 1975.

INSTRUCTIONS FOR MAKING 1974/75 TESTS

(1) Carefully read general instructions for test methodology and log keeping and retention requirements, Pages 1 to 7.

(2) Individual tests are detailed on Pages 7 through 32.

(3) Test "logging forms" are shown immediately after each individual test.

(4) An entry point is given so that the exact location of all tests can be entered as they are made.

(5) An entry point is given for the test-maker to detail or list the equipment utilized to make the test, with serial numbers where known.

(6) An entry point is given so that the test-maker can note the results of each test as made.

(7) **NOTE:** These tests, as detailed, are for so-called grandfathered systems, in operation before March 31, 1972. The requirement for this year for all grandfathered systems is that **the tests be made.** It is **not** necessary that grandfathered systems meet (i.e. satisfy) the actual technical standards or requirements in this year's tests.

Exception: Section 76.605 (a) (12), radiation tests, detailed on Pages 18 to 21, are specifications (i.e. tests) which must be complied with this year.

(8) Two tests, **hum modulation** 76.605 (a) (7), Page 22, and **in-channel frequency response** 76.605 (a) (8), Page 26, are virtually impossible to perform with only an FSM/SLM. However, the hum-modulation test can be checked through a visual (picture tube) inspection. The in-channel frequency response test requires an FSM/SLM and a signal generator, or sweep generator.

Systems simply unable to make these tests are advised that a clear statement on the appropriate logging form as to **why** the tests cannot be performed will **possibly** satisfy this year's testing requirement, from a common sense point of view, although it may create difficulties for the system operator should an inspecting team from the FCC come to the system. Still, it would be better to indicate in the logging form why the tests could not be completed, than to simply "skip" the test(s) with no explanation.

(9) Indicate here _____ the date of the completion of all 1974/75 Compliance Tests required; the date which this completed test form logging book is filed into your permanent office files for your system (note: this logging report form must be kept on file for five years).

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Instructions for general use of this Handbook will be found on the inside back cover.

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